



Decentralized wastewater heat recovery and its effects on wastewater treatment

CONCLUSIONS

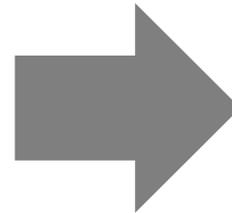
SEMINAR PRESENTATION 1.11.2022

The potential and effects of property-specific wastewater heat recovery were examined based on two key KPIs

Inputs

KPIs

- 1 The total energy benefit of property-specific heat recovery
- 2 The effects of property-specific heat recovery in the wastewater network
- 3 The effects of wastewater temperature on the nitrogen load of treated wastewater
- 4 Effects of increasing nitrogen load on wastewater treatment plant capacity



Energy benefit in relation to the **increase in nitrogen load** at the wastewater treatment plant



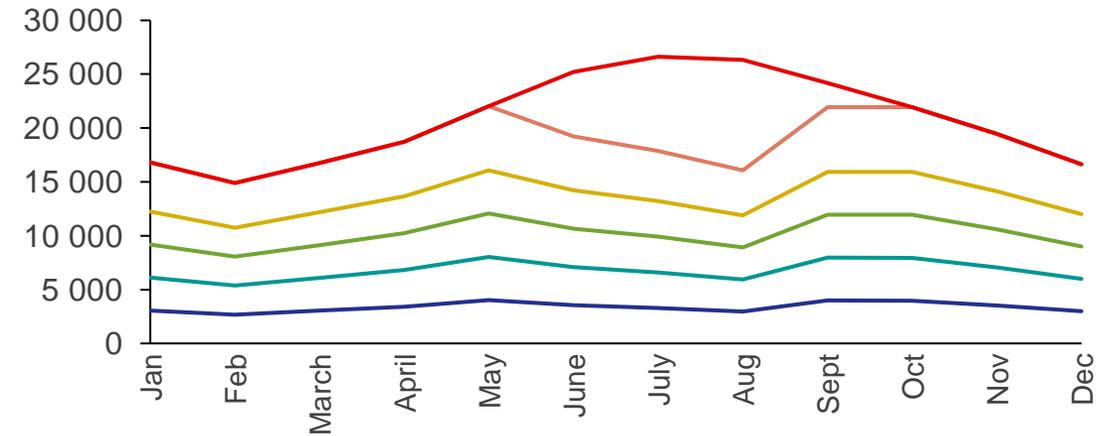
Energy benefit in relation to the **costs** of increasing wastewater treatment **plant capacity**

Property-specific wastewater heat recovery has significant potential, but potentially also a large impact on the nitrogen load

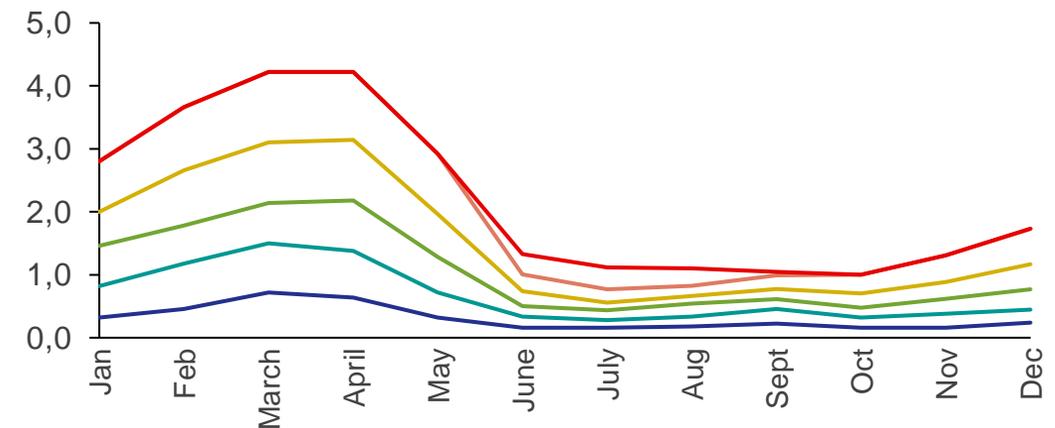


- Six scenarios were modeled in the project, in which **heat recovery and heat pump solutions covered 25 – 100 %** of the small houses and apartment buildings in the area.
- The net energy benefit is affected by e.g. temperature of wastewater and ground as well as heat demand of buildings.
- If the temperature of the wastewater arriving at the wastewater treatment plant is low, **a one-degree change** in temperature affects the nitrogen load **significantly more** than at high temperatures.

Net energy benefit in case Turku (MWh/month)



Ammonium nitrogen concentration increase in case Turku (mg/l)



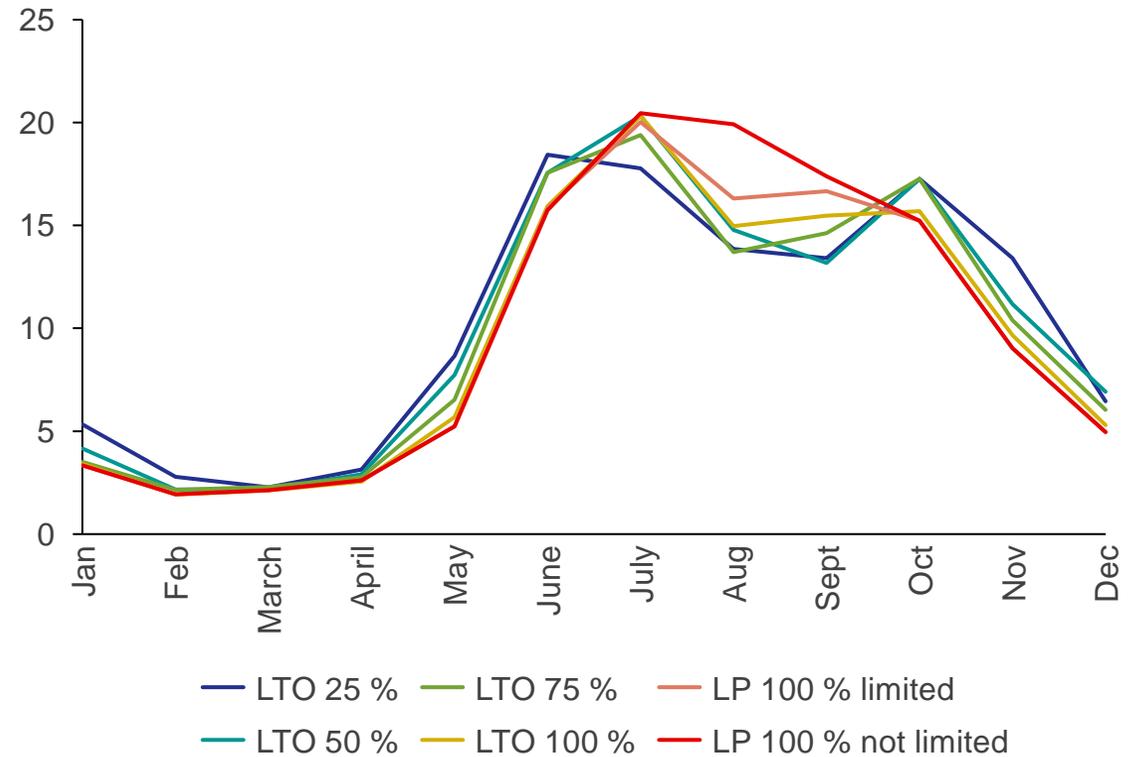
— LTO 25 %
 — LTO 75 %
 — LP 100 % limited
— LTO 50 %
 — LTO 100 %
 — LP 100 % not limited

The net energy benefit in relation to the growth of the ammonium nitrogen load at the wastewater treatment plant is greatest in the summer months



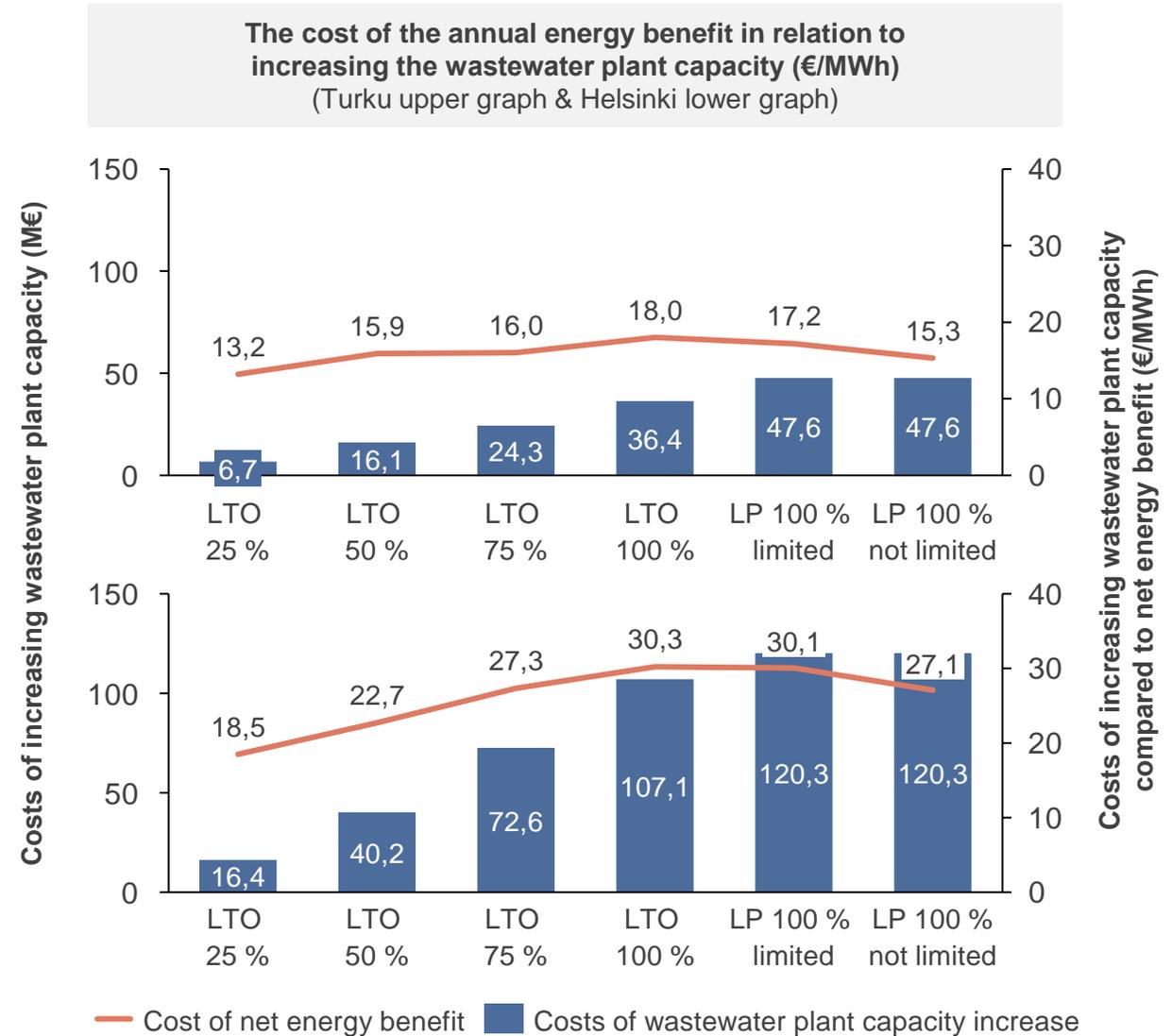
- In the summer months, **heat recovery is limited** by the heat demand of the buildings, but a bigger factor in the results is the increase in the ammonium nitrogen load, which is **significantly higher in the winter than in the summer months**.
- In the case example of Turku, the energy benefit in relation to the wastewater flow was estimated to be greater than in the case example of Helsinki, which is why the energy benefit in relation to the increase in ammonium nitrogen load was also estimated to be greater.

Energy benefit in relation to the ammonium nitrogen load increase in case Turku (MWh/kg/month)



The heat recovered from wastewater at properties can cause investment needs for a wastewater treatment plant

- In the project, a boundary condition was determined that the nitrogen load of the treated wastewater must not increase.
- The volume increase of the process was estimated to be about **7,5 % for every 1 °C decrease** in the wastewater temperature.
- The **cost of increasing** the wastewater treatment plant **capacity** in the example cases was estimated to be around **13 - 30 €/MWh**.
- The cost of the energy benefit does not include e.g. the increasing OPEX of the treatment plant nor the investment costs of heat recovery solutions at buildings.



Key takeaways



Property-specific wastewater heat recovery has significant potential



Utilization of waste heat from wastewater requires significant investments



There is potential in the heat recovery and cooling of domestic water that can be utilized without harm to the various parties in the water supply system



Property-specific heat recovery may require additional regulation, which would be implemented primarily through connection agreements



The assessment of the overall profitability of the wastewater heat recovery at a system level requires further studies

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